Energy-efficient solutions: an overview of technologies

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Eskom Energy Management Information Pack: Brochure 6

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Energy-efficient solutions:
an overview of technologies

Switching to energy-efficient technologies, products, systems and processes is a sure way to lower your organisation's energy usage, increase productivity, reduce waste and cut operating costs.

Investment in energy-efficient solutions remains low risk - it is recouped over time through cost savings that keep on giving month after month.

The timeline to deploy energy-efficient technology retrofits or replacements in your organisation depends on numerous factors - amongst others:

- The nature of your operation
- The potential impact of retrofits on your operation
- The energy intensity - and age - of your current equipment
- Available budget.

An energy assessment can provide crucial information on your organisation's pattern of energy usage, energy consumption and demand as well as possible areas of energy wastage and help guide decisions around how, when and where to action retrofits.

Refer to How to do a walk-through energy assessment - Brochure 3 in the Eskom Energy Management Information Pack - for more information.

Since businesses in the commercial, industrial and agricultural sectors use a multitude of technologies, systems and processes, this brochure aims to cover the most common energy-efficient technologies and how they can be applied in your organisation, including:

- Lighting
- Water heating
- Insulation
- Motors
- Variable Speed Drives
- Photovoltaics

Refer to HVAC systems: energy-efficient use and technologies - Brochure 5 in the Eskom Energy Management Information Pack - for more information.

Lighting

Lighting accounts for 18% of the electricity consumption in the commercial sector and 26% in the industrial sector in South Africa.

With a comparatively low investment, marked savings can be achieved through:

- Understanding your organisation's lighting requirement
- Analysing inefficiencies
- Replacing conventional inefficient lighting systems with energy-saving lighting technologies.

New generation lighting systems use less electricity, are kinder to the environment and generally have a longer lifespan than older lighting technologies.

A large variety of components available today means there is an energy-efficient solution to solve almost any lighting inefficiency.

Important note!

Energy efficiency should always be a key consideration when evaluating and selecting lamps for your organisation, provided the following properties meet the quality criteria for lighting applications:

- Colour
- Colour rendering - the ability of a light source to accurately render all frequencies of its colour spectrum
- Luminance - the intensity of light emitted from a surface per unit area in a given direction
- Luminous flux - the energy per unit time (dQ/dt) radiated from a source over visible wavelengths
- Lamp lumen depreciation - the values that reflect the overall performance of a lamp over its lifespan
- Lifespan
- Size
- Starting-up and running characteristics
- Dimming capacities.

There are significant differences between the efficiencies, colour and colour rendering of different types of lights.

Measures to take note of are:

- Lumen (lm) – the power of light emitted by a lamp and perceived by the human eye
- Luminous efficacy – a lamp's ability to convert electrical power into visible light expressed in lumens per watt (lm/W)
- Colour rendering index – how well a lamp, on a scale of 0 to 100, renders colour. (For instance, a lamp with a CRI of 100 makes objects appear as they do in sunlight).

Compact Fluorescent Lamps (CFLs)

Featuring a curved or folded gas-filled tube (to fit into the space of an incandescent lamp) and a compact electronic ballast on its base, CFLs radiate a spectral power distribution different from those of incandescent lamps - better phosphor formulations have improved the perceived colour of light emitted by CFLs to such a degree that some sources rate the best "soft white" CFLs as "subjectively similar in colour" to standard incandescent lamps.

Compact Fluorescent Lamp - spiral (left); U-shaped (right)

*The lighting technologies in this brochure are only examples and not a complete list of available lamps in the market.

Compared to a standard incandescent lamp, CFLs:

- Use one-fifth to one-third of the electricity
- Last eight times longer
- Although more expensive, can save over five times its purchase price in electricity costs over its lifetime.

CFLs contain a tiny amount (about 5mg) of mercury that is almost used up by the time lamps are ready for disposal - they do not pose a health risk if handled and disposed of carefully.

Remember: Failed or used-up CFLs must be disposed of at appropriate municipal waste sites or sign-posted electronic waste (e-Waste) sites. Reputable e-waste disposal services can also be contracted to do it on behalf of your organisation.

Wide range of application

Replacement of magnetic ballasts with electronic ballasts has removed most of the flickering and slow starting traditionally associated with fluorescent lighting, and has allowed the development of smaller CFLs directly interchangeable with many more sizes of incandescent lamps.

Long lifespan

CFLs typically have a service life of 8000 hours compared to 1000 hours for incandescent lamps. However, the actual lifetime of any lamp depends on many factors, including:

- Operating voltage
- Defects
- Exposure to voltage spikes
- Mechanical shock
- On/off frequency
- Lamp orientation
- Ambient operating temperature.

The lifespan of a CFL is shortened if it is turned on and off frequently; light output decay is exponential - by the end of their lives, CFLs can be expected to produce 70 to 80% of their original light output.

Cool

Besides using up to 75% less energy than incandescent lamps and lasting up to 15 times longer, CFLs also emit less heat, which means that heat produced by lighting in a building will be lower when CFLs are fitted.

In commercial or industrial buildings where air conditioning is almost always required, CFLs reduce the load on the cooling system and, therefore, contribute to additional energy savings.

Dimming

Very few types of CFLs have dimming capabilities. The dimming range of dimmable CFLs is usually between 20 and 90%.

- However, many modern CFLs have a dimmable range of 2 to 100%, more akin to that of incandescent lights.
- Cold-cathode CFLs can be dimmed to low levels, making them popular replacements for incandescent bulbs on dimmer circuits.

When a CFL is dimmed, its colour temperature (warmth) stays the same, which is counter to most other light sources where colour gets redder as the light source gets dimmer.

The dimmer switch used in conjunction with a dimmable CFL must be matched to its power consumption range.

Light Emitting Diodes (LEDs)

LEDs use less electricity to operate and produce more light per watt than most of the other light sources - they are about 85% more energy-efficient than conventional incandescent lamps and about 5% more efficient than Compact Fluorescent Lamps (CFLs).

LEDs:

- Have a quick start up time
- Produce full light capacity as soon as they are switched on
- Turn off immediately so there's no 'fading' as the lamp cools down once turned off
- Have a colour temperature (warmth) comparable to that of incandescent lamps (colour temperature plays a role in how people perceive colour and experience thermal comfort in buildings).

Long lifespan

Generally, LEDs can last up to five times longer than CFLs, which last about six times longer than incandescent lamps. Unlike CFLs and incandescent lamps, LEDs do not burn out or fail; they experience lumen depreciation, where the amount of light produced decreases and light colour appearance can shift over time.

The lifetime of a LED is based on the prediction that the light output decreases by 30%.

Wide range of application LEDs:

- Come in an array of sizes, starting with tiny lamps measuring 5mm
- Are available in a range of shapes and colours for a variety of applications
- Are extremely versatile, offering impressive flexibility in colour changing and light distribution.

An LED lamp that replaces a CFL or incandescent lamp consists of a number of LED chips.

Some LEDs are directly compatible drop-in replacements for incandescent or fluorescent lamps - LED packaging may show:

- Lumen output
- Power consumption in watts
- Colour temperature in Kelvin or description (e.g. "warm white")
- The equivalent wattage of an incandescent lamp of similar luminous output.

LEDs are adversely affected by high temperature and, typically, include heat dissipation elements such as heat sinks and cooling fins – see the picture below.

Retrofitting or replacement

LEDs can easily replace common compact fluorescent or incandescent lamps - in a wide range of applications.
LEDS are made with standard lamp connections and shapes, such as:

- An Edison screw base
- An MR16 shape with a bi-pin base
- A GU5.3 (bi-pin cap)
- A GU10 (bayonet fitting).
- A B22 bayonet cap.

LEDs are compatible with the voltage supplied to sockets and include circuitry to rectify AC power and convert voltage to an appropriate value.

LED Flood lights can reduce security lighting costs by up to 50% and last up to 20 times longer than Halogen

Dramatic improvements in technology broadened the applicability of LED luminaires for hazardous, industrial and other highly demanding locations. Moreover, LED luminaires can deliver longer life, enhanced energy efficiency, reduced maintenance demands and equal or better quality light than conventional lighting technologies.

Dimming

LEDs are fully dimmable - some models are compatible with dimmers used for incandescent lamps.

Power factor

High power factor solutions are required for LED bulbs and fixtures. A low power factor indicates an inefficient LED product - LEDs with a power factor of less than 1 could result in:

- Harmonics from the LED bulb/fixture degrading the electricity line and affecting the performance of other equipment on the line
- More current in the transmission lines leading to more power loss in the form of heat and, therefore, wasted energy
- Negatively impacting the environment by increasing the overall energy consumption and, therefore, greenhouse gas emissions.

Electronic ballasts versus magnetic ballasts

In addition to not flickering and being quieter than magnetic ballasts, electronic ballasts have many other advantages - they:

- Are energy-efficient and environmentally friendly;
- Are smaller and weigh less;
- Can be used as a single ballast in 3 and 4-lamp luminaries; and
- Can be used in lamps that are in parallel and series mode - if one of the lamps goes out it will not affect the other lamps even though all the lamps are using the same ballast.

Induction lamps

Induction lamps are a relatively old energy-saving lighting technology suitable for:

- High-ceiling applications where lamps are difficult, costly or hazardous to access
- Applications where the advantages of fluorescent lighting are sought but light sources are needed that can start and operate efficiently in cold temperatures.

Unlike most conventional lamps in commercial and industrial building applications - such as Sodium Vapour and Metal Halides - induction lamps have an instant "on" and hot re-strike, which makes it suitable for a wide range of applications, including:

- Warehouses
- Cafeterias
- Gymnasiums
- Cold stores
- Parking garages
- Outdoor areas
- Tunnels
- Bridges
- Roadways.

Induction lamps have a high power factor due to it's low loss in 98% efficient high frequency electronic ballasts. Moreover, these lamps are environmentally friendly because they use less energy and mercury per hour of operation than conventional lighting - mercury is in solid form and can be easily recovered for recycling.

Induction lamps

Long lifespan

Depending on the type and model, these lamps have a lifespan of 80,000 to 100, 000 hours.

Luminous efficacy

When considering commercial and industrial lighting applications and using a 200W fixture as an example, an induction lamp will produce 16,000 Lumens and an LED 11,000 Lumens - about 31% less light - with the same energy input.

All the above benefits will translate into energy and maintenance cost savings of around 50% compared to energy inefficient lamps.

Sodium Vapour lamps

High-pressure and Low-pressure Sodium Vapour lamps are a type of High Intensity Discharge (HID) lamp that uses sodium under pressure as the primary light-producing element. These lamps have a low colour rendering but are more energy-efficient than Metal Halides in areas or

applications where good colour rendering is not a priority, such as security, roadway and parking lot lighting.

Sodium Vapour lamps

Mercury Vapour lamps

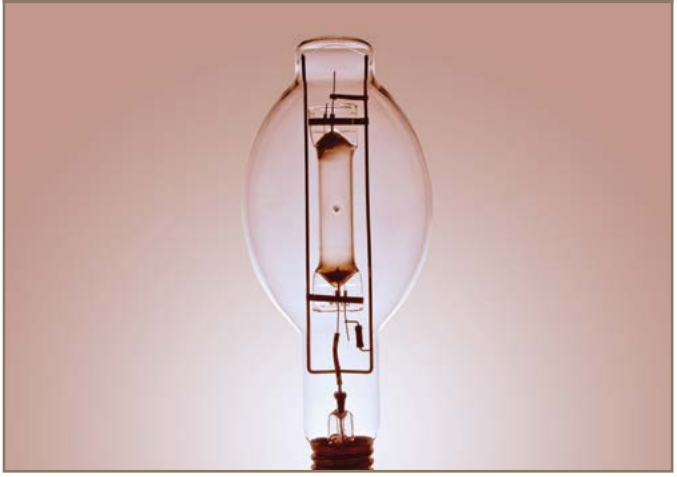
A Mercury Vapour lamp is a gas discharge lamp that uses an electric arc through vaporised mercury to produce light. With luminous efficacies of 35 to 65 lumens/watt, these lamps - commonly referred to as HBO lamps - are more energy-efficient than incandescent and most fluorescent lights.

Their other advantages are:

- A long lifespan in the range of 24,000 hours
- High intensity, clear white light output.

They are mostly used for overhead lighting in large areas such as in factories, warehouses and sports arenas. (Producing white light with a bluish-green tint that is not flattering to human skin, Mercury Vapour Lamps are typically not used in retail stores).

Mercury Vapour lamps



Requiring a warm-up period of four to seven minutes to reach full light output, these lamps are an old technology becoming obsolete due to the high efficiency and better colour balance of Metal Halide lamps.

Metal Halide lamps

Amongst the most energy-efficient white light sources that offer good colour rendering, Metal Halide lamps can be used in a range of commercial and residential applications, both indoors and outdoors.

They typically have a three- to five-minute start to full brightness and a four- to 20-minute restrike time.

Metal Halide lamp

Halogen lamps

A Halogen lamp is a type of incandescent lamp that uses halogen gas to increase both light output and rated life. These lamps are only slightly more energy-efficient than incandescent lamps but are fully dimmable and have very good colour rendering and a long lifespan.

Halogen lamps

Lighting controls

Lighting control systems have become a key component of energy-efficient lighting and limit electricity wastage by controlling when and in which quantities light is emitted where needed.

- Occupancy sensors control lighting based on occupant detection in intermittently occupied areas such as board rooms, conference rooms, print rooms, store rooms and toilets.
- Daylight sensors brighten, dim or even switch off lights according to changing natural light levels.
- Sensors can be positioned on walls, corners or ceilings to provide the best detection area for each application. Programmable lighting control systems can switch lights off automatically or reduce lighting levels according to night time security or occupancy requirements.

50% of existing buildings

Lighting controls have become a key component of energy-efficient lighting and have been shown to reduce energy consumption by up to 50% in existing buildings and at least 35% in new buildings - these savings can be the result of reduced electricity usage; reduced Heating, Ventilation and Air Conditioning; lower maintenance costs and improved productivity.

35% of new buildings

Quick tips	√
Replace incandescent lamps with Compact Fluorescent Lamps (CFLs) or Light Emitting Diodes (LEDs)	
Replace T-12 with T-8 or T-5 fluorescents	
Replace 400W Metal Halides with 360W Metal Halides or, preferably, 250W and 200W Metal Halides (where a reduction in light levels is acceptable)	
Replace high-intensity discharge lamps such as Halogen lamps with Metal Halides or high-pressure Sodium lamps	
Replace conventional control gear with electronic control gear	
Remove unnecessary lamps and ballasts in over-lit areas	
Replace fluorescent lamps in high-ceiling applications with Induction lamps - they have ultra-long life spans and are perfect when good colour recognition is required.	
Replace conventional High Intensity Discharge (HID) lamps in high-ceiling applications with T-Bay lamps - they are available in two body sizes accommodating from two to eight lamps.	

Water heating

Water heating can account for up to 40% of the cost to operate in commercial buildings - hospitals, hotels and universities, in particular, consume vast volumes of hot water.

Electrical element geysers consume 8% of the electricity used in the commercial sector and 3% in the industrial sector in South Africa.

Solar water heating

Replacing your conventional electric element geysers with solar water heating systems can reduce your organisation's water heating costs by up to 24% - depending on the systems installed, how they are used and the climate they operate in, savings could be even higher.

Power of the sun

Solar panels, or collectors, on a building's roof absorb heat from the sun and transfer it efficiently to heat water piped through the collectors – the hot water collects in storage tanks with the help of electrical pumps and controls. It is supplied to taps and outlets in a building in the same way as electric element geysers.

Back-up is required for commercial buildings

Depending on the system installed and how it is used, a solar water heating system can provide between 50 and 90% of your building's hot water requirements. Installing a back-up electric element with a timer is essential to switch on the system for short periods when the demand for hot water is high and to heat water when it is cloudy or on rainy days.

System types

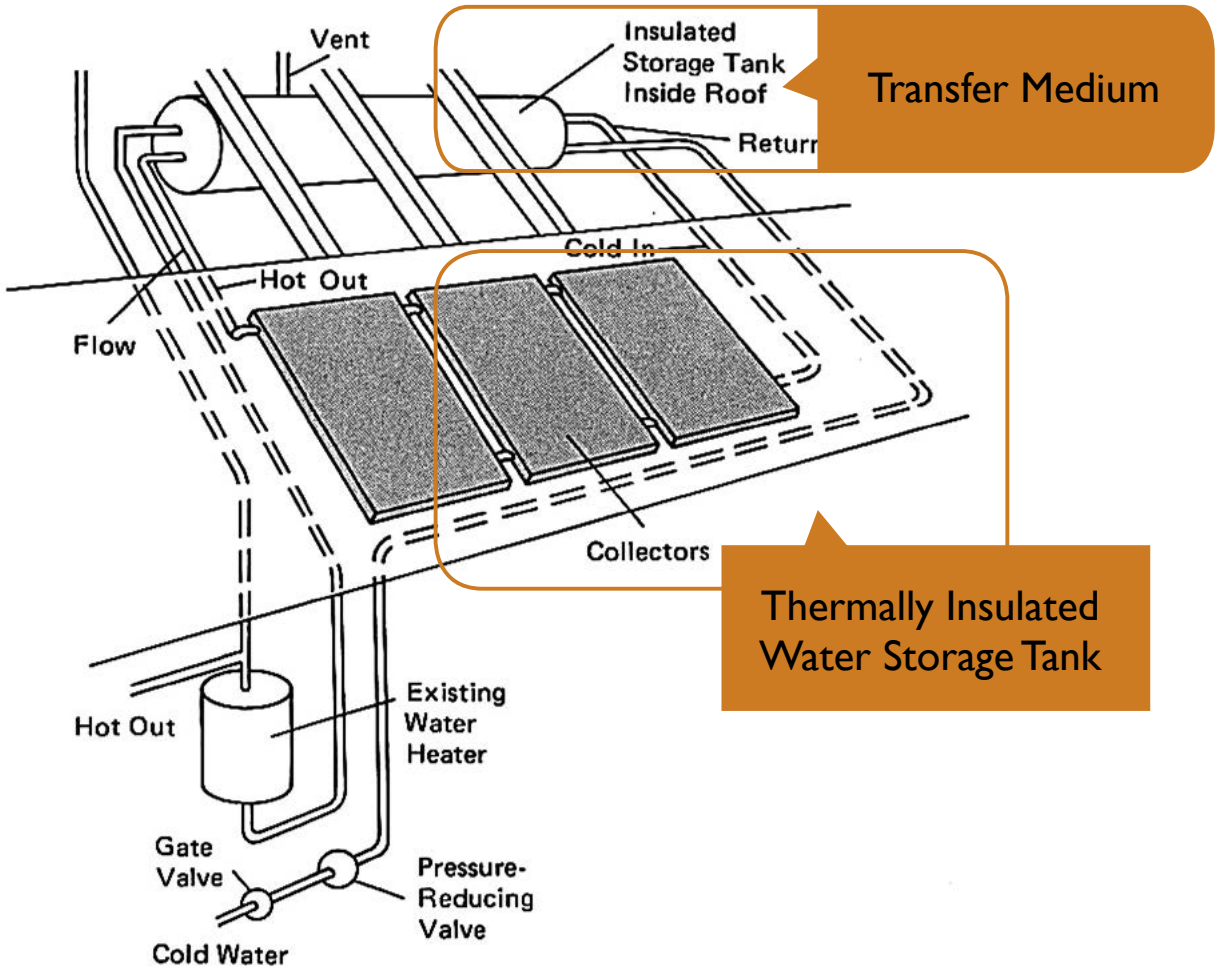
There are two types of active systems:

- Direct - water moves through the solar collectors and gets heated before being deposited into a storage tank with the help of electric pumps and controls.
- Indirect - the solar collectors heat a "heat transfer" fluid, such as antifreeze; water gets heated by the antifreeze (but never mixes with it) before being deposited into a storage tank with the help of electric pumps and controls.

There are two types of passive systems (that use nothing but the forces of nature):

- Batch - a tank is situated inside a solar collector and water gets heated inside the tank; gravity or natural convection moves hot water from the tank to a building's pipes.
- Thermo-siphon - the tank is separate from the solar collector and water gets heated by moving through the tubes of the collector; natural convection pumps hot water into the tank from where it travels to a building's pipes.

WATER HEATING SYSTEMS: THERMOSIPHON AND SINGLE TANK



Components - solar water heating system

Choosing the right system for your building

- The SABS carries out freeze tests to ascertain whether systems can withstand low temperatures. Non-frost areas tend to be in a narrow band of the South African coast line, whereas all inland areas are prone to frost. So, if your building is inland, you should install a system able to withstand frost conditions.
- Furthermore, water in South Africa can be very corrosive, especially when hot. If systems are not manufactured to withstand our water quality some components will not last for the entire guarantee period; critical parts that should be suitable for South Africa's water are valves, copper pipes and the lining of the storage vessel. (Indirect systems can handle both frost and poor water quality).
- Finally, systems should be configured for South Africa's high levels of radiation levels.

Always ask a reputable supplier for advice and never install a system that is not SABS approved. The SABS Mark of Approval offers the best assurance of quality and verifies that the system has been tested and meets safety, quality and performance requirements. The mark can only be used on systems that:

- Have passed rigorous SABS testing
- Have been produced by manufacturers that have undergone a manufacturing quality audit and, therefore, meet SABS specifications.

Installation

Solar panels are mostly installed on the roof or mounted on custom made stands next to a building to ensure correct positioning to the sun and to avoid shaded areas on the roof.

The expected lifespan of a solar water heater is 10 to 15 years – most systems are guaranteed for five years.

Maintenance

Solar water heaters are relatively low maintenance:

- Solar flat plate and vacuum tube collectors should be kept clean and dust free to work optimally. (In areas where minimal rain is experienced, they should be washed at least every six months)
- Evacuated tubes require little maintenance but need to be replaced when they lose their vacuum or if cracked or broken
- Glycol in indirect systems should be checked on a regular basis to ensure optimal performance
- Replacing the hot water cylinder sacrificial anode might be necessary
- Including a mixing valve, non-return valve and pressure relief valve to help prevent overheating in evacuated tube systems is advisable.

Heat pumps

Under ideal conditions, heat pumps are three times more energy-efficient than conventional electric element geysers - they only use electricity to drive compressors and fans instead of using electricity to heat water. Deriving energy from the air, which is available in unlimited amounts 24 hours a day, this technology is sustainable and has a much lower environmental impact than conventional geysers.

Heat pumps work on the same principle as the heating component of an HVAC (Heating, Ventilation and Air Conditioning) system

An air-to-water heat pump draws energy from the surrounding air and transfers it to the water that needs to be heated. Energy from an external source (such as electricity) is used to drive the pump's compressor and fan, which is required to transfer the heat from the environment to the water. Water is circulated between the heat pump and a storage tank. Every time the water passes through the heat pump the temperature of the water is raised by a few degrees Celsius until it reaches the set point at which the heat pump will switch off.

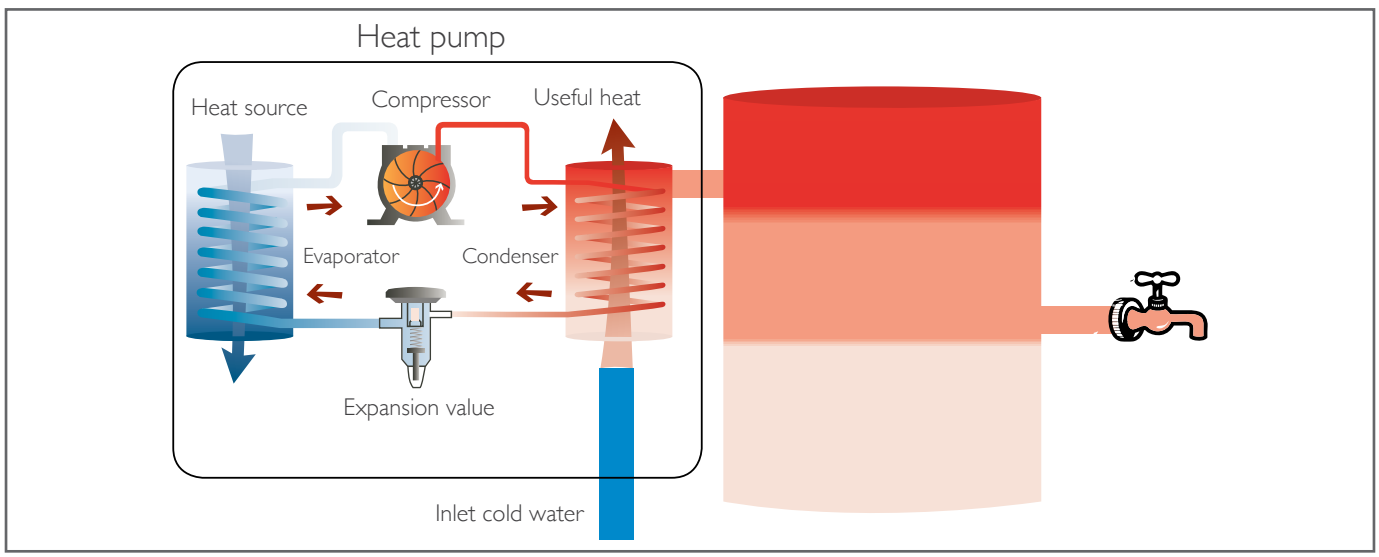
Technology characteristics:

- Heat pumps are dependent on electricity supply to operate and can produce hot water any time of the day. (The majority of large commercial models requires a three-phase electricity supply).
- Units are designed to work outside in temperatures as low as -10^{0}C and at night.
- Units cannot freeze or overheat - heat pumps offer system protection against frost conditions.
- Performance is influenced by ambient temperature conditions - i.e. low ambient = low efficiency; high ambient = high efficiency. (Seasonal variations ensure good average efficiency).

Maintenance

Heat pumps require some maintenance and regular servicing:

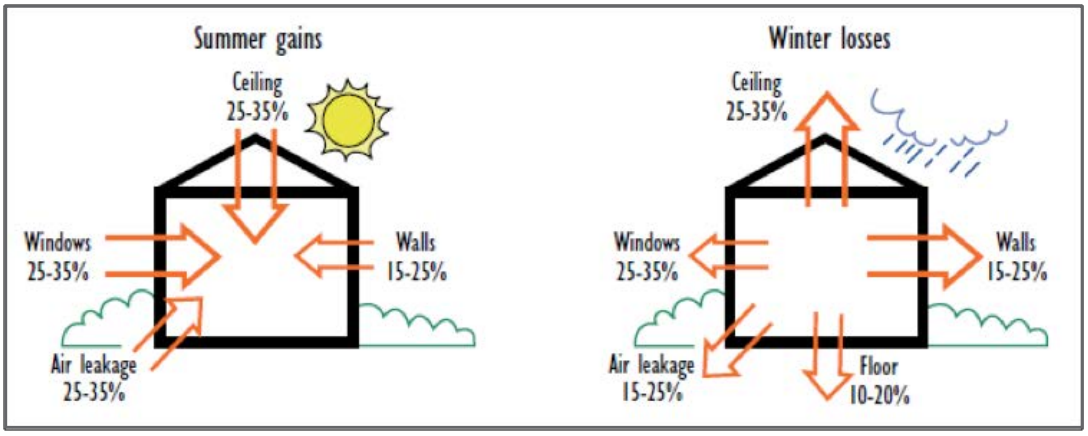
- Keep the coil surface area clean from debris, leaves and dust
- Inspect the system for any water or gas leaks
- Clean the in-line strainer, which can be done by the home owner
- Check the heat pump refrigerant gas levels on a regular basis.



Insulation

Insulated buildings stay cooler in summer and warmer in winter and temperatures throughout the year are more constant - insulation is the most energy-efficient way to curb the natural flow of warm air towards cooler spaces, thereby limiting heat loss from the inside and heat gain from the outside.

This figure shows where the summer gains and winter losses occur.



The effectiveness of insulation is evaluated by its R-value, a measure of how well insulation resists heat transfer.

Insulation can be divided into three categories:

1. **Bulk insulation** mainly resists or slows down the transfer of heat by conduction and convection; and it relies on pockets of trapped air or low conductive gasses within a structure

2. **Reflective foil insulation** mainly resists radiant heat flow due to reflection low radiant heat absorption and low emissivity; it is more effective at reducing summer heat gain, than reducing heat losses in winter

3. **Composite bulk insulation** combines some features of both bulk and reflective foil insulation. Examples include foil bonded blankets or boards.

Insulation options

- Fire-retardant ceiling insulation - consult your supplier about the type of insulation materials that do not attract rodents.
- Caulking and weather-stripping - it is the best way to seal cracks and holes to stop cold air from getting in during winter.
- Draught-proofing doors and windows - external doors can be fitted with 'door sweeps' on all closing surfaces.
- Blinds, curtains and shade awnings are great for improving thermal insulation - a system of automatically controlled sun blinds can track the sun as it moves across your building to prevent heat gain and control solar glare.
- Double glazed windows reduce heat loss and gain and external noise pollution - it also minimises the use of artificial lighting by maximising natural light penetration into a building.
- Reflective roof coatings can improve the thermal insulation of buildings depending on climatic conditions, building location and building envelope efficiency.
- Insulating geysers and hot water pipes limits heat loss while water is stored or in transit through a building's pipes, thereby lessening the burden on the geyser to keep the water at the desired temperature.

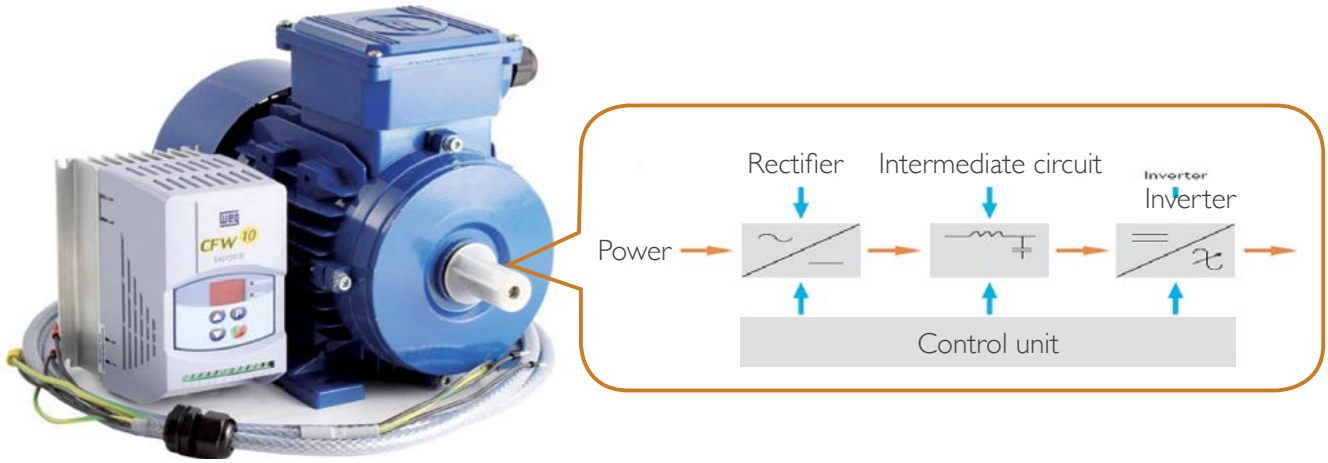
An insulated room requires 51% less energy to heat up than one that isn't.

Variable Speed Drives (VSDs)

A VSD saves electricity by regulating the speed and rotational force, or torque output, of an electric motor to better match output with load - motors and other equipment often use more electricity than they need because they are designed to cope with a maximum load that rarely or never occurs.

Variable Speed Drives are typically 92 to 95% efficient with between 5% and 8% losses due to additional heat dissipation caused by the high frequency electrical switching and the additional power required by the electric components - the losses are usually more than compensated for by the savings at the motor.

This picture shows how VSD components operate to supply variable voltage and frequency.



A VSD slowing down a fan or pump motor from 100 to 80% can save as much as 50% on energy use.

Applications

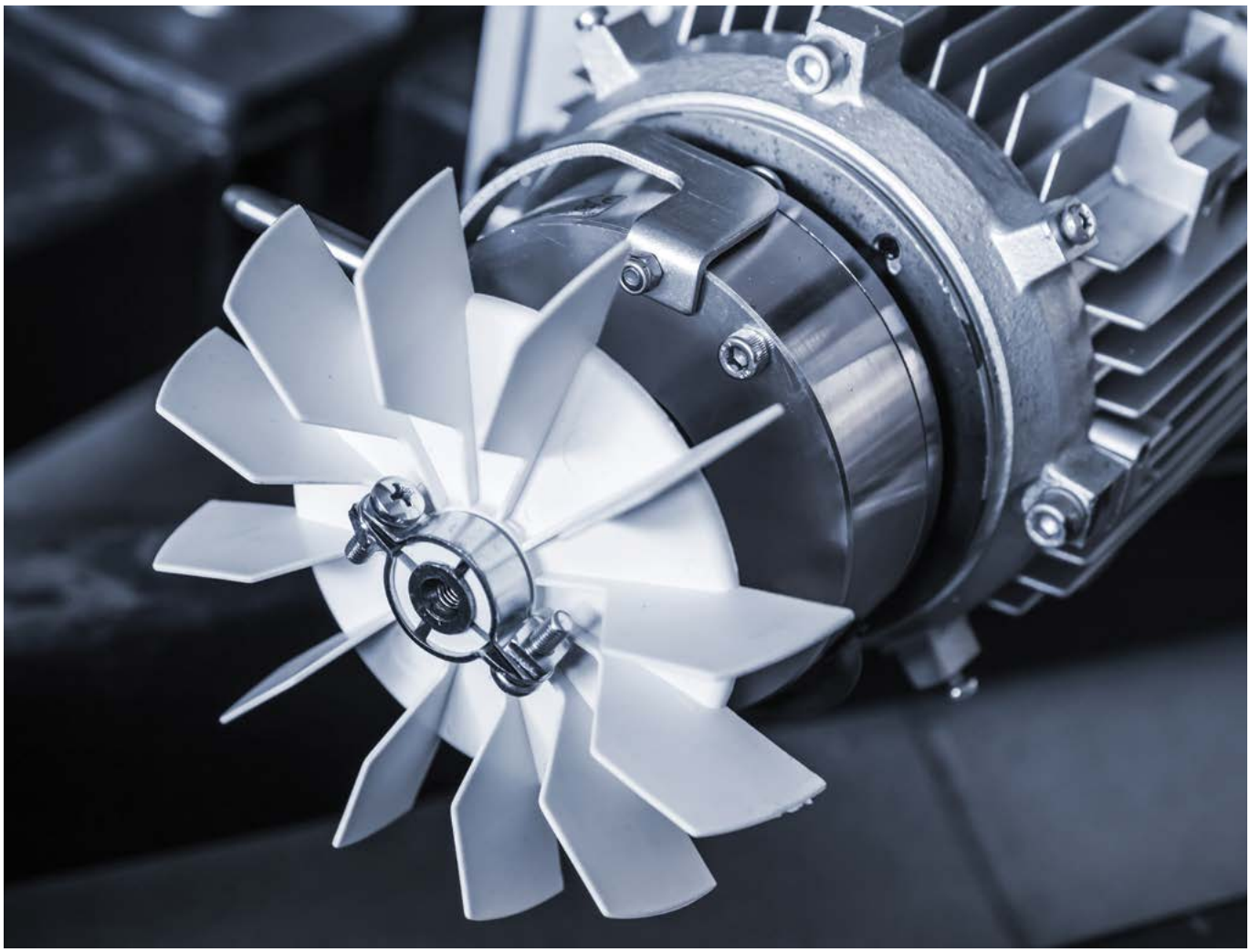
- VSDs are extremely versatile and can be used to optimise the energy efficiency on a wide range of equipment - from pumps and fans, lifts, conveyors and ventilation systems to compressors and, cold and freezer rooms.
- VSDs come in many sizes and are typically encased in boxes that can be as small as a milk carton or as big as a wardrobe, depending on the size of the motor or motors they regulate.
- VSDs range from 0,18kW to several MW.
- VSDs are available as standalone devices and are connected to a motor's electrical supply.
- On some smaller motor designs, usually under 15kW, a VSD may be built onto the motor as an integrated motor-drive product.

When considering VSDs, care must be taken to ensure that it is the correct technology solution for your organisation and that it is properly applied to achieve optimal energy savings. Energy savings achieved can result in the investment in VSDs being recovered in as little as a few months.

Other benefits of VSDs:

- Protect faults in electric motor and cables
- Balance and regulate voltage
- Feature smooth soft starting
- Reduce starting current and maintenance
- Lower mechanical stresses and damages
- Correct the power factor to approximately 0.98 (certain models)
- Record energy consumption and energy savings (certain models)
- Have emergency set points and trips to protect equipment and motor
- Are equipped with automatic speed control.
- Ensure precise process control
- Eliminate broken "tyre type" couplings on pumps due to high starting torques
- Ride through power dips
- Restart automatically after power outages
- Have pressure or flow interlocking systems
- Communicate with moisture gauges
- Integrate easily with SCADA or an existing PLC system
- Are adaptable to most systems
- Are simple to install, configure and use
- Increase the lifespan of systems.

VSDs could, potentially, increase harmonics on the electricity supply network and influence readings, measurements and the life expectancy of electronic equipment when used without the appropriate filters and chokes.



Heat recovery systems

Heat recovery systems can be used to improve the energy efficiency of commercial buildings by capturing and reusing heat generated by wastewater systems. A drain heat recovery system captures heat from wastewater as it is flushed down the drain. In many cases, the wastewater passes through a copper coil filled with a refrigerant that removes the heat from the water and then transports it to warm the water in hot water storage tanks, which is then distributed throughout the building to supply showers, sinks and other fixtures.

Heat can also be recovered from ventilation systems. A building's heating unit produces warm air, which is distributed via ductwork. A second set of ductwork collects stale air and brings it back to the unit so it can be expelled from the building. A heat recovery system can be used to remove some or all of the heat from the air.

In a heat recovery ventilation system, as the exhaust air travels back to the furnace, it passes through a copper heat exchange coil. The coil collects heat from the air and transfers it through the unit to the fresh air supply.

This recovered heating energy is then used to warm the fresh air before it is distributed through the building. The exhaust air and the fresh air supply never meet, so there is no risk of stale air being transported back into the duct system.

Heat can be recovered from refrigeration systems to heat water (as is the case with heat from the exhaust air of tumble driers). This exhaust air can be filtered and used for zone heating as well.

Heat recovery systems help to reduce energy consumption and lower operating costs.

Sourced from: http://www.florad.co.za

Solar photovoltaic

The potential of photovoltaic (solar PV) technology to power business is being shown at a number of sites across South Africa.

Lincoln on the Lake, a commercial building in Umhlanga Ridge, KwaZulu-Natal, runs almost completely off-grid, saving about 87 000 kilowatt hours of electricity a year. The building is fed by 234 rooftop photovoltaic panels - to date the largest photovoltaic (PV) installation at a commercial building in the province.

The panels generate about 238 kilowatt hours (kWh) per day.

Leveraging the sun's energy, Lincoln on the Lake is anticipated to achieve a minimum carbon saving of 89 610 kg CO_2 per annum and a certified emissions reduction of 89,6 kg CO_2 per annum.

- Solar PV is used primarily to operate grid-connected appliances, equipment, lighting and air conditioning in all types of commercial and industrial buildings.
- Panels can be ground mounted, installed on rooftops or designed into building materials at the point of manufacturing.
- PV modules can be grouped together and connected in an array to provide any level of power requirements, from mere watts (W) to kilowatts (kW) and megawatts (MW).

The size of the solar array, battery bank and AC inverter required for a typical solar PV installation depends on a number of factors, such as:

- The amount of electricity your building uses
- The amount of sunlight on-site
- The number of days required without back-up
- Peak electricity demand at any given time.

Sufficient battery storage can easily allow a solar PV system to operate fully independently of the national electricity grid or generator back-up.

Note!

- In the case of grid tied systems, there are regulations that companies must work through with Eskom and the relevant municipalities to allow own electricity generation. Island systems not connected to the grid do not have to inform supply authorities - they are treated the same as standby generators.
- There is an existing approved process for allowing generators to be connected to Eskom's medium and higher voltage networks. This will also be applicable when the connection of grid tied low voltage systems has been approved.

Find it at:
www.eskom.co.za/Whatweredoing/InfoSiteForIPPs/Pages/Guide_To_Independent_Power_Producer_IPP_Processes.aspx

Credits:

The information in this brochure has been sourced from:

- www.carbontrust.com
- www.florad.co.za

The Eskom Energy Management Information Pack comprises:

Energy management action plan	Brochure 1
Business case for energy efficiency	Brochure 2
How to do a walk-through energy assessment: methodology and checklist	Brochure 3
Creating an energy awareness programme: behavioural change at work	Brochure 4
HVAC systems: energy-efficient use and technologies	Brochure 5
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Green growth cycle: energy efficiency in support of competitiveness	Brochure 7

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